No of Pages : 4 **Course Code: 08P005**

Roll No:
(To be filled in by the candidate)

PSG COLLEGE OF TECHNOLOGY, COIMBATORE - 641 004

SEMESTER EXAMINATIONS, OCTOBER / NOVEMBER - 2015

BE(SW) – PRODUCTION ENGINEERING **Semester: 9**

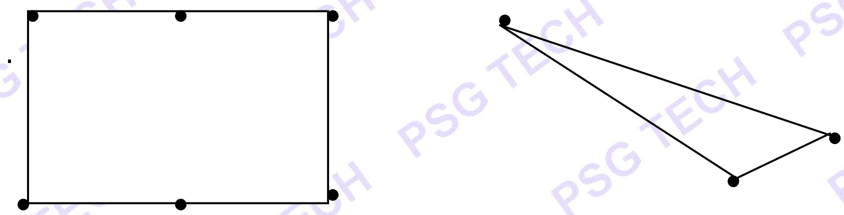
08P005 FINITE ELEMENT APPLICATIONS IN MANUFACTURING

Time : 3 Hours **Maximum Marks: 100**

INSTRUCTIONS:
1. Group I and Group II questions should be answered in the Main Answer Book. 2. Answer any **5** questions in Group II. 3. Answer **ALL** questions in Group I and Group III. 4. Group III – **Multiple Choice questions -** (which will be given to the candidates half an hour before the scheduled close of the examination) **should be answered only** in the space provided **in the Main Answer Book.** 5. **Use of design data book/tables is not permitted** 6. **No charts/graph sheets to be provided.**

GROUP I **Marks: 10 X 3 = 30**

1. Relate displacement field, velocity field and strain rates as used in metal forming.
2. Calculate the values of shape functions at selected nodes for a quadrilateral element with 4 nodes and sketch the variation.
3. What is incompressibility condition in metal froming? How is it useful in FEA of metal forming problems?
4. Study the elements shown and indicate whether they can be used for analysis. Justify the answer and indicate corrections if any.



5. Express instantaneous power in metal forming as a function of stress and strains.
6. Indicate two metal forming problems where plane strain conditions prevail. Justify.
7. What is meant by element connectivity?
8. Present the boundary conditions at the casting –mold interface in metal casting with appropriate mathematical expressions.
9. Name a few software (2 each) solutions that can be used for the simulation of (a) metal forming processes (b) metal casting processes (c) welding processes (d) plastic injection molding processes.
10. Highlight the relevance of any three contour plots obtained from a typical injection molding simulation.

No of Pages : 4 **Course Code: 08P005**

GROUP II **Marks: 5 x12 = 60**

11. Discuss the modules that are needed in a simple metal forming simulation software that is FEA based. Highlight the functions of each module.

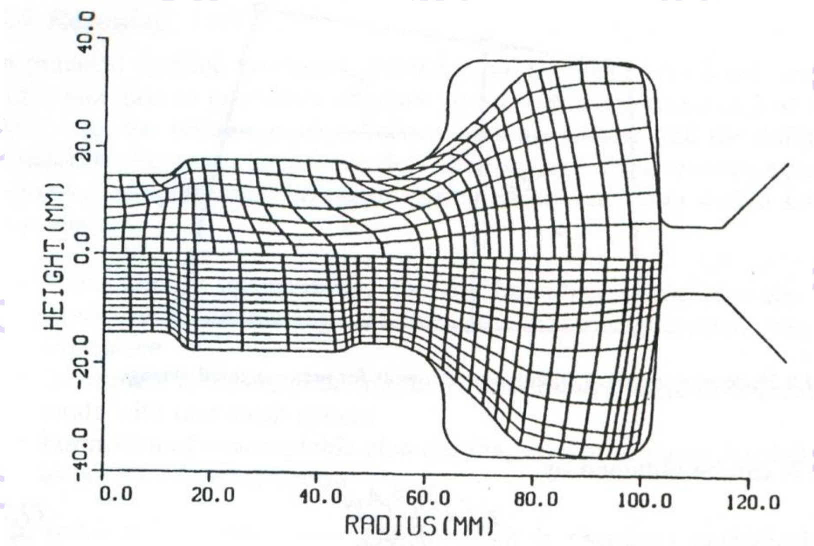
12. Study the figure attached. Identify the critical location/s that need/s analysis. This component is to be cast and therefore suggest a simulation technique in a CAE software that is finite element based. The model, BCs and ICs are to be explained. How will the result be interpreted?

13. Study the figure attached. Identify the component. Tooling is to be developed for this component using simulation to avoid errors. Using CAE approach, provide a step by step method to develop the tooling.

14. Represent the general flow chart that may be used to develop a source code for providing solutions for welding problems. Starting from the governing equations formulate the finite element model for solving welding problems.

15. Obtain the expression for the strain rate matrix as needed in the metal forming problem under general conditions, starting from the fundamentals.

16. Study the figure below that represents deformation of metallic component while simulated. Interpret the observations and discuss the method used to generate two types meshing.



No of Pages : 4 **Course Code: 08P005**

Roll No:

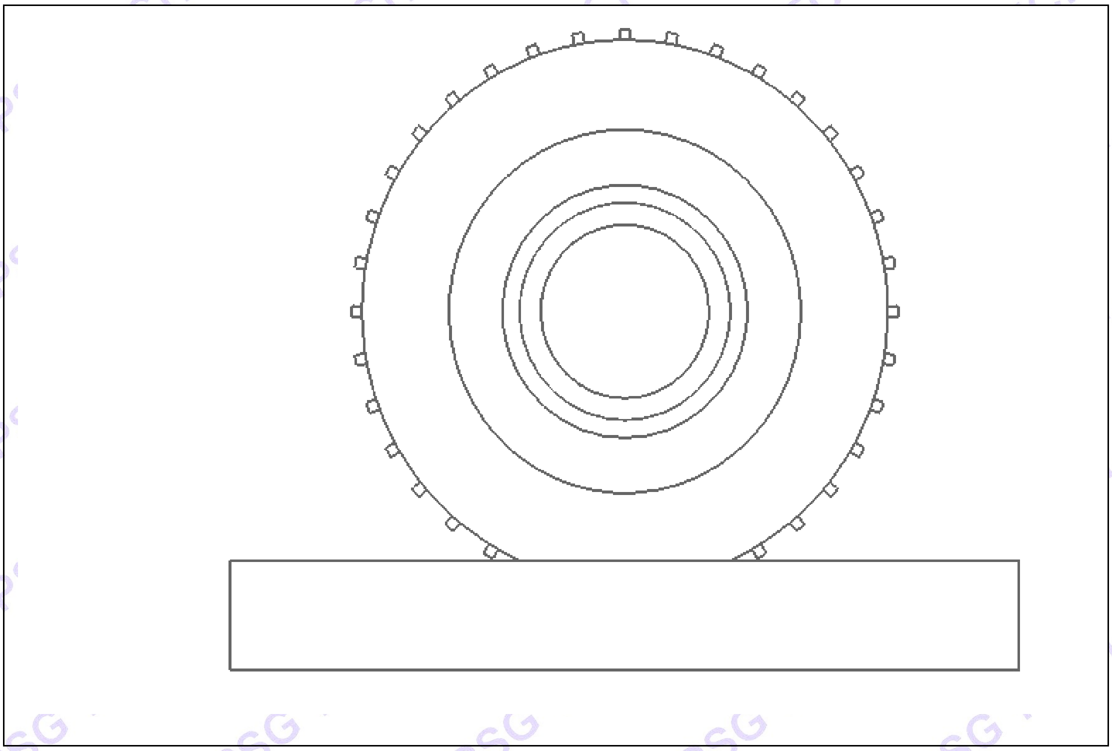


Figure for Qn. No. 12

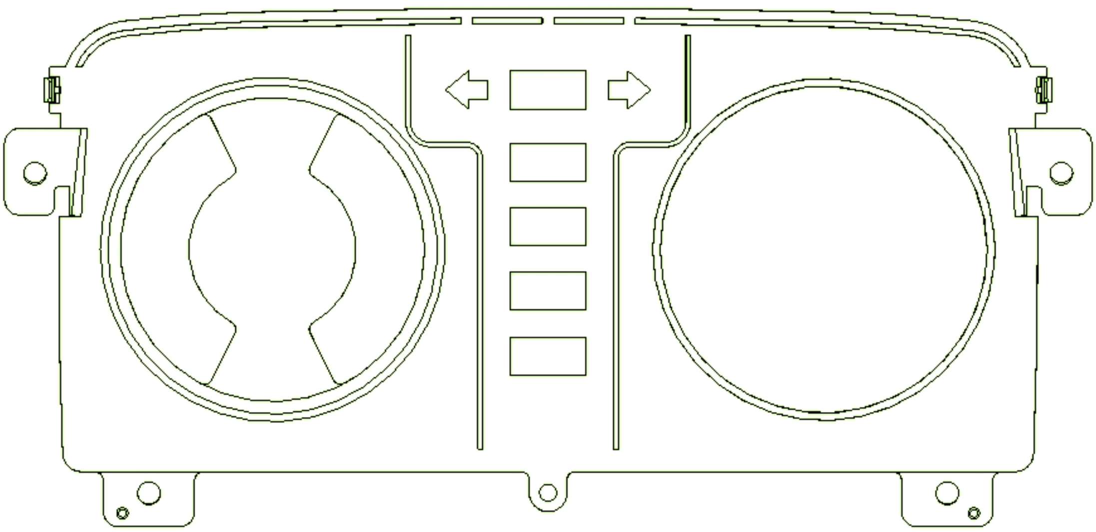


Figure for Qn. No. 13

/END/

FD/RL

No of Pages : 4 **Course Code: 08P005**

Roll No:

Write the Alphabet of your choice answer for each question in the space provided in the Main Answer Book
(Do not attach this question paper along with the Main Answer Book)

OCTOBER / NOVEMBER – 2015

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GROUP III **Marks: 10 X 1=10**

I) If the top die is moving with a velocity V_Z m/s in the XZ plane in an upsetting problem, plane strain will prevail in the XZ plane if

A) Vx is zero **B)** Vy is zero **C)** Vy is half of V_Z **D)** $Vy + Vx = 0$

II) Transformation function is same as shape function for

A) isoparametric elements **B)** triangular elements
C) rectangular elements **D)** brick element

III) Generally a CAD model can be transferred to a CAE environment

A) in its native form **B)** with converters **C)** with some loss of data **D)** B,C

IV) With a 3 noded triangular element the partial derivative of velocity field w.r.t coordinates is

A) constant **B)** variable **C)** indeterminate **D)** zero

V) Assertion(A)A software that can analyse metal casting problems can simulate injection molding problems, Reasoning(R): The softwares for casting and molding are developed on same principles

A) A is false, R is false **B)** A is false R is true
C) A is true, R is false **D)** A is true, R is true

VI) A hotspot in metal casting is the point

A) to freeze at the end **B)** to freeze in the beginning
C) where two streams meet **D)** where shrinkage may occur

VII) In welding HAZ can be determined by a

A) stress analysis **B)** thermal analysis
C) dynamic analysis **D)** thermomechanical analysis

VIII) An entity that is not there in an FEA based CAE software is

A)an efficient CAD modeller **B)** preprocessor **C)** post procesor **D)** solver

IX) Assertion:(A) Convenional tensile test data is not useful for producing parts by metal forming processes,

Reasoning: R: Conventional tensile test data is valid for small strains

A) A is true, R is true **B)** A is true, R is true and R is the correct reason for A
C) A is false, R is true **D)** A is false, R is false

X) In bulk metal forming processes, the mesh is to be regenerated as

A) large deformations take place **B)** previous meshes are lost
C) shape is changed **D)** A,B